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FEASIBILITY STUDY FOR GAS POWER PLANT PROJECT IN KABUPATEN MUARA ENIM

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Abstract-*Kabupaten Enim Muara is one of the districts producing oil and natural gas in Indonesia, but in recent years a decline in lifting in the area which resulted in reduced revenue sharing from oil and gas sector gained Enim Muara District. In the calculation of revenue sharing, there was a significant decline in 2010 that only about 50% from 2009, while the sharing of natural gas, District of Muara Enim get an increase, and dipresiksi will continue to increase. Because of this, Kabupaten Enim Muara plans to increase revenue by utilizing the distribution of natural gas lifting results. One of the businesses that will be entered by the Kabupaten Muara Enim is the construction of gas power plants. Before running the gas power plant project, Kabupaten Enim Muara will conduct an analysis of the distribution of natural gas they will get, after which it will be converted into the amount of generating capacity that can be built. After that, it can be seen the amount of generating capacity that can be built, then the authors can calculate the amount of the costs incurred, and the price of electricity to be sold to PLN, because electricity prices are calculated based on the costs incurred by an electric generator. From the data that has been calculated, the authors could analyze the feasibility of a gas power plant for Development of these. From the feasibility study analysis conducted, it can be concluded that the construction of gas power plants is feasible to run, it can be seen from a positive NPV (USD 15,175,775), the IRR exceeds the cost of capital (13.12%), more than one PI (1.23), and also the project payback is relatively fast through 6.25 years.*
Keywords: lifing, profit sharing, gas power plants, feasibility studies, montecarlo.

1. Introduction

Kabupaten Muara Enim is one of the areas that most of its area is located in southern Sumatra basin, this resulted in high content of hydrocarbons in the area. The deposit of mineral resources and geothermal, Mining and Energy services of *Kabupaten* Muara Enim predicts that Oil has a potential deposit are 252.397,06 MSTB and 12.477,07 BSCF for natural gas deposit. From the results of lifting crude oil and natural gas are still in production, *Kabupaten* Muara Enim makes oil and gas became one of the mainstays in increasing revenue (Pendapatan Asli Daerah). However, *Kabupaten* Muara Enim local government is not satisfied with the amount of revenue that comes from sharing lifting of petroleum and natural gas. Therefore, the Government of the *Kabupaten* Muara Enim business plans for petroleum and natural gas. The government regulation 32 of 2004 about Regional Government, the Authority to carry out oil and gas activities of local government lies only in the downstream business. So that *Kabupaten* Enim Muara Government will utilize sharing lifting petroleum and natural gas for new business.

Table 1. Oil and Natural Gas Lifting in *Kabupaten* Muara Enim

	2009	2010	2011	2012
Crude Oil (barrel)	29,200,477.73	23,885,419.52	6,733,100.25	4,703,572.49
Natural Gas Lifting (MMBTU)	35,931,793.88	35,870,910.08	51,209,504.16	56,308,498.98

From the results of Petroleum and Natural Gas lifting, *Kabupaten* Muara Enim can be seen that there is a lifting decrease in Petroleum is a significant, this can occur because the amount of oil reserves are running out. However, lifting the number of natural gas in the *Kabupaten* Muara Enim continues to increase. This resulted in the opportunity to enter to the use of natural gas is much more attractive than the use of petroleum. One of the businesses in the utilization of natural gas that will be proposed is the construction of natural gas power plants. So to proposing the construction of this power plant will be carried out feasibility study of this project.

2. Business Issue Exploration

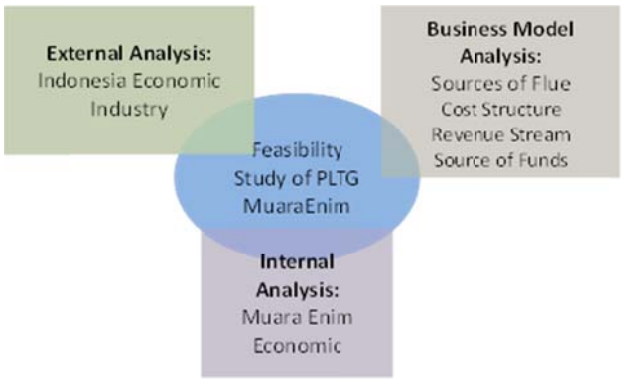

Figure 1. Conceptual Fremework

There are various conditions that need to be considered, such as the external conditions (Macro Economic and Industry analysis) and internal conditions (Muara Enim Economic) that may affect project feasibility, financial feasibility calculations should be done with carefully and complexity of calculation depends on the complexity aspects need to be considered. External analysis is very important to understand the situation of the business will be executed and predict the future of the business. External analysis will help companies make strategic business decisions. In the analysis of power plant construction, external analysis will be conducted using PESTEL analysis model to see the macro economic conditions, while the model of Porter's Five Forces analysis is used to analyze the power plant industry.

2.1. PESTEL

2.1.1. Politic/Legal

Core business activities in the oil and gas industry are divided into two business activities: upstream and downstream activities. Government regulation No. 22 in 2001 on Oil and Gas Article 5 stated that 'upstream and downstream business activities as mentioned can be executed by: (a) state-owned enterprises, (b) regionally owned enterprises; (c) cooperatives, small businesses, and (d) private entities ". In the Oil and Gas business, local government can only act in downstream area. The rule can be found at government regulation No. 32 in 2004 on Regional Government, which stated

that "authority to carry out the government's oil and gas region lies only in the downstream business activities."

So in this case the local government of Muara Enim District can only undertake downstream oil and gas activities. One-on-one downstream business that can be done is the construction of a power plant to natural gas power.

For the selling price of electricity to PLN, it will be calculated based on the costs listed in the Ministerial ESDM Regulation No.04 in 2012.

2.1.2. Economic

The increasing amount of electricity production will support the growth of the national economy by the increase in electricity consumption will increase economic activities, which affects the output of the economy is better. Also going the opposite effect, where good economic growth will increase demand for electricity.

In RUPTL 2012, PLN estimates electricity growth in 2011-2020, assuming the need Java-Bali will grow 7.8% per year, for Western Indonesia 10, 2% per year and for Eastern Indonesia will grow 10.8% per year. Indonesia's electricity needs will grow an average of 8.46% per year.

Referring to the analysis of the PLN, any economic growth requires the support of at least 1% of the electricity consumption growth of 1.5%. When referring to this standard, the average economic growth during 2006-2011 was 5.8% and ideally followed by the growth of power consumption by about 8.73% per year. During the same period, the national electricity consumption only grew by an average of 7% per year. Therefore, there is shortage of electricity in Indonesia.

2.1.3. `Social/Environment

Gas power plant is a power plant that is still using resources that are not renewable, and natural gas reserves are becoming increasingly depleted, in addition, many countries have launched to reduce emissions caused by global warming has been one of the reasons is energy consumption is not environment, and gas power plant is a power plant expend quite a lot but not as high emission coal.

2.1.4. Technology

Technologies can influence and change a lot of parts of the business. This effect may occur, especially for process materials and products. There are many inventions that use the latest technology to create added value for the user. Of course, the application of technology to be evaluated from the costs and benefits that followed. Natural gas-fired power plant natural gas is the primary technology used for electricity generation in the world. Because low capital cost, power is often used for smelter energy sources, especially in Indonesia.

2.2. Porter's Five Forces Analysis

2.2.1. Threat of New Entries

Construction of power plants require huge investments. The electricity is generated, the funds needed. Given the cost of capital and a few rules that need to be adhered to in the manufacturing plant, the entry barrier for power projects is quite high.

2.2.2. Bargaining Power of Supplier

Technology for natural gas power plant has become more common. There are many suppliers for the equipment to be used, resulting in low switching cost. Besides, it has a lot of equipment from China that has the most competitive price. Under these circumstances, the bargaining power of suppliers is low.

2.2.3. Bargaining Power of Buyer

Parties can buy electricity in Indonesia is PLN as the holder of the power of electrical power business and also private. The selling price of electricity to PLN under the rules set by government ministers EMR. It can be concluded bargaining power of buyers is still quite high.

2.2.4. Threat of Substitute Products

S Some are quite popular alternative power than gas power plants, including the coal-fired power plants, geothermal. Geothermal power plant is a plant that is very popular today, because geothermal is environmentally friendly and is also one-one resource that many have in Indonesia, besides geothermal power plant is also one of carbon-free power generation. It can be concluded Threat of substitute products is in the middle category.

2.2.5. Rivalry among Existing Firm

There are several companies engaged in the power generation industry, and largely controlled by PLN Indonesia. In addition to PLN, besides PLN company engaged in the business is not too much, is because of government policies in this sector development consent only started in 2002. The number of existing companies is relatively low and relatively high electricity demand, so competitions between the competitors are weak.

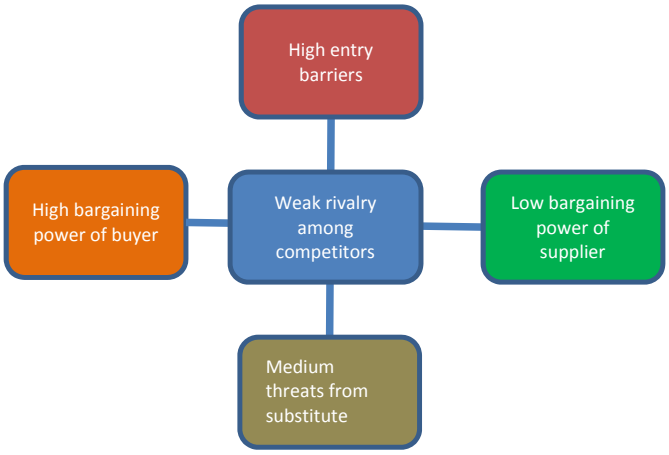

Figure 3 Porter's Five Forces Analysis

2.3. Internal Analysis

Internal analysis will be done by looking at the potential of the *Kabupaten* Muara Enim. *Kabupaten* Enim Muara is rich in mining sector. Mining sector has an important role in *Kabupaten* Muara Enim economics, either gas or oil and non-oil and gas structured. In Oil and gas structure, Dominant contribution of mining sector is formed by oil and gas products, while another is still dominant contributed by coal production. Mining and Energy services of *Kabupaten* Muara Enim Predicts Oil that has a potential deposit are 252,397.06 MSTB and 12477.07 BSCF for natural gas deposit. For data lifting natural gas can be seen in the table and graph below

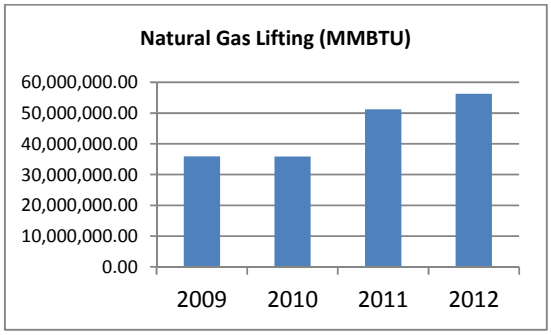

Figure 4 *Kabupaten* Muara Enim Natural Gas Lifting

While the power supply in the district of *Kabupaten* Muara Enim obtained from the Tanjung Enim power plant which is a large-scale electricity generation. The establishment is not only to local electricity supplied need, but also to supplied electricity need in South of Sumatra Which connected by South of Sumatra interconnection transmission link. By the total of electricity power during 2009, 1.592.623,054 Mwh was distributed out of the region and 161.181,946 Mwh for the company used. Compared to the previous year, that increased by 55,42 percent, and that one decreased by 4.41 percent.

2.4. Sources of Flue

fuel for the power plant to be made in the *Kabupaten* Muara Enim is a revenue sharing lifting of natural gas in the area. For how to distribute the proceeds will be seen in the following diagram:

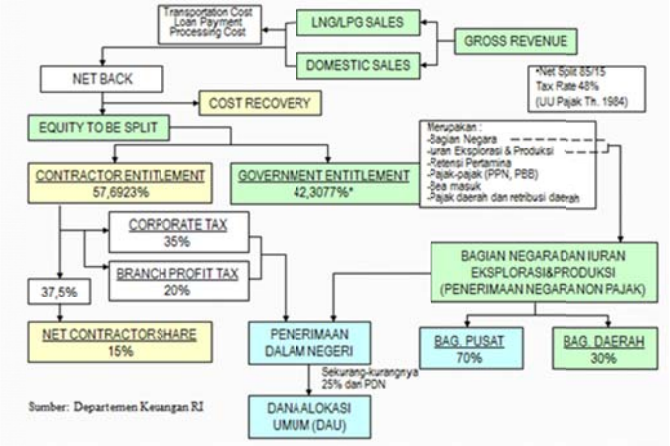

Figure 5 Obtaining flows portion receiving area KPS-Gas

From the chart above it can be seen governments only get 30% of the Government Entitlement. Local governments are referred to in the chart, is a combination of both provincial and district governments natural gas producer. Where *Kabupaten* government producing only get 12%, while the rest is the right of the 6% of the provincial government and local *Kabupaten* or cities that are in the producing districts of the province to get a share of 12%.

2.5. CAPEX

Initial investment to be incurred in the construction of the power plant can be seen in cost engineering procurement and construction (EPC cost).

2.6. OPEX

Operating expenses consist of fixed cost and variable cost, which will be used for operational and maintenance.

Fixed operational and maintenance cost are consisted of:

- General affair and management cost
- Operation and maintenance cost
- Labor cost
- Land and building tax
- Property insurance
- Life cycle maintenance
- Contingency

Apart from the fixed cost has been discussed, gas power plants also have the cost of fuel in the form of natural gas that must be held to produce the final product.

2.7. Source of revenues

Benefits to be gained from this project came from the sale of electricity to PLN. According to ministerial regulations EMR No. 4 in 2012, the price of electricity derived from renewable resources will not be done in by the Power Supply Business Plan (RUPTL) PT PLN (Limited) which was approved by the Minister of Energy and Mineral Resources.

In a ESDM ministerial regulation No.05 in 2009, In executing power purchase plan, PT PLN (Limited) shall make Estimate Price (HPS) as a reference, calculated based on plant type, plant location, the amount of capacity, In the calculation of cost-based transfer price, the energy price divided into four components:

- Component A : Capacity Charge

  The capacity payment provides for the recovery of capitalized development and capital expenditure, financing fees, interest during construction and fixed cost such as taxes and insurance during construction, and return on investment. The capacity charge is monthly charge

regardless of the amount of energy taken. This component is constructed as a flat rate in Power Purchase Agreement. The formula of Component A defined as follows:

- Component B : Fixed Operational and Maintenance (FOAM) Charge

Operation and Maintenance capacity payment is tariff component calculated base on the company spent to do operation and maintenance. The operating costs are divided into: Fixed Operating and Maintenance Cost (FOAM) and Variable Operating and Maintenance Cost (VOAM). The formula of component B – FOAM defined as follows:

- Component C : Fuel Charge

The fuel cost refers to coal, limestone, and fuel oil (MFO/ HSD) when the power plant has been operated.

- Component D : Variable Operational and Maintenance (VOM) Charge

The variable cost is calculated considerate the water treatment and other costs that influence to energy consumed or plant capacity. But generally the variable cost used for steam power plant is assumed $ 0.030 (referred to on going project with similar capacity).

2.8. Source of Fund

Source of funds to be used to build a natural gas power plant *Kabupaten* Muara Enim will be done using:

- Target debt-to-equity ratio is 70:30,
- Debt will be using average from interest rate in Indonesia banks.

3. Business Solution

Business solution will be divided into two sections:

- The number of natural gas sharing obtained by the *Kabupaten* Muara Enim local government,
- Feasibility Study for PLTG.

3.1. The number of natural gas sharing obtained by the *Kabupaten* Muara Enim local government.

From the literature study it can be seen governments only get 30% of that is reflected in the Government Entitlement. Local governments are referred to in the chart, is a combination of provincial and district governments natural gas producer. Where the producing *Kabupaten* only get 12%, while the rest is the right of the 6% of the provincial government and the others *kabupaten* or cities that are in the producing *Kabupaten* of the province to get a share of 12%.

3.1.1. Cost Recovery

Cost Recovery (CR) is the cost of investment and operation of oil and gas Contractor issued production, and paid the Government in Indonesia/GOI philosophic results for production, which is more clearly reflected in the scheme for the results of PSC.

Table 2 .Average Cost recovery in Indonesia

	Cost Recovery
2009	28%
2010	29%
2011	26%
2012	25%

Average cost recovery in Indonesia still tending to high enough, that ranged between 25 % until 29 % of 2009-2012 year

3.1.2. Indonesia Gas Price

To determine the amount of revenue from the sale of natural gas, then, we need to know the price of natural gas in advance.

Table **Error! No text of specified style in document.** Indonesia Gas Price

	Gas Price
2009	2.8
2010	3
2011	5
2012	5.5

The price of natural gas taken from the average of the GSA (gas sales agreement). To be able to compute revenue from the sale of natural gas in the IDR then, writer take BI middle rate main as a reference.

After the revenue from natural gas sales minus cost recovery, then we can calculate the amount of revenue sharing that would be obtained by the *Kabupaten* Muara Enim.

Table 4. *Kabupaten* Muara Enim Natural Gas Revenue Sharing

	2009	2010	2011	2012
Natural Gas Lifting (MMBTU)	35,931,793.88	35,870,910.08	51,209,504.16	56,308,498.98
Average cost recovery	27.97%	29.00%	26.00%	25.00%
cost recovery (%)	10,051,779.97	10,402,563.92	13,314,471.08	14,077,124.74
Sharing (MMBTU)	25,880,013.91	25,468,346.16	37,895,033.08	42,231,374.23
Government Entitlement (%)	42.04%	42.04%	42.04%	42.04%
Government Entitlement (MMBTU)	10,879,362.61	10,706,306.95	15,930,200.32	17,753,098.41
Kabupaten Muara Enim share (%)	12.00%	12.00%	12.00%	12.00%
Kabupaten Muara Enim share (MMBTU)	1,305,523.51	1,284,756.83	1,911,624.04	2,130,371.81
Growth		-1.59%	48.79%	11.44%
* Projection				

From the data above, it can be seen that the *Kabupaten* Muara Enim get the highest revenue sharing of natural gas in 2012, revenue sharing are increasing from year 2011 and is expected to continue to rise.

3.2. Feasibility Study for *PLTG*.

From the results of some of revenue sharing gas, which is obtained by *Kabupaten* Enim Muara, will be used to build a power plant, power plant is expected to increase revenue of *Kabupaten* Muara Enim. To eliminate the risk of fluctuations in natural gas lifting *Kabupaten* Enim Muara, the business enterprises that will run the power plant will only use about 2.000.000 MMBTU of natural gas, although it is expected to increase lifting natural gas in the years ahead in this area.

By using 2.000.000 MMBTU of natural gas, the energy required to be obtained is 2.110.112 GJ, which can generate electricity generated at 255,851 MWh / year. So installed capacity for this power plant is 35MW.

Table 5 Specific Assumptions of Electric Capacity

	Unit	GT
Installed capacity	MW	35
Axillary Consumption (3.66%)	MW	1.4
Net electricity	MW	33.6
Capacity factor (85%)	%	85%
Operating hours	hours/year	8,640
Gross electricity	MWh/year	255,851
Net electricity	MWh/year	246,487

3.3. Financial Analysis

3.3.1. WACC

From the information above (section 2.6.4), it can be concluded that:

- Target debt-to-equity ratio is 70:30,
- Debt will be using average from interest rate in Indonesia banks.

Cost of debt before tax for Kabupaten Muara Enim's PLTG using prime lending rate for corporate from average interest rate in Indonesia banks in USD (Bank Indonesia, 2012) is as follow at 4.92%.
Based on Government Regulation No. 36 Year 2008 about income tax, which came into effect from January 1, 2010, companies are taxed at a single rate of 25%.
Cost of equity is calculated using the Capital Asset Pricing Model (CAPM).
CAPM = risk-free rate + (β × (Premium Risk))
Risk free rate using the BI rate as the base, where the BI rate used at 5.75% for the period July 12, 2012 (Bank Indonesia, 2012).
In order to estimate the beta leverage for power plant projects *Kabupaten* Enim Muara, will be used power plant companies from Damodaran, this is because of this limitation data on public companies in Indonesia engaged in power plan.

Table 7. Average Unleveraged Beta US Electric Utility Company

Position	Number of Firms	Unleveraged Beta	weighted Unleveraged Beta
Central	21	0.75	0.28
East	21	0.70	0.26
West	14	0.75	0.19
Total	56		0.73

Source: Damodaran.com

The overall are 56 companies engaged in power generation, which spread in Central, East, West U.S.. Beta value of each region is relatively different, so unleveraged beta that will be used to represent the power industry plan is 0.73. Beta value will also be applied to power plant *Kabupaten* Muara Enim. Furthermore unleveraged beta will be calculated by entering the composition of debt-to-equity leverage ratio to produce beta.
Leverage beta = 0.73 X (1+(1-0.25)X233%
= 2.01

According to research by PT Danareksa Sekuritas, in 2011 Indonesia lower its risk premium for investing from 7.35% as of 3 January 2011 to 6.18% as of 30 December 2011 (PT Danareksa Sekuritas, 2012).
From the data has been described above, the WACC calculation is:

Table 8 WACC Calculation

Valuation Assumption	
Proposed Debt (Wd)	**70.00%**
Proposed Equity (We)	**30.00%**
Risk Free Rate (Rf)	**5.75%**
Risk Premium	**6.18%**
Taxes	**25%**
Levered Beta	
Unlevered Beta	0.73
Leverage (D/E)	233%
Levered Beta	**2.01**
WACC Calculation	
Cost of Equity	**18.2%**
Pre-Tax Net Cost of Debt	4.92%
After Tax Cost of Debt	**3.69%**
Debt Contribution to WACC	2.0779%
Equity Contribution to WACC	5.45%
WACC	**6.56%**

3.3.2. CAPEX *and OPEX*

To build the capacity of 35 MW power plant in the *Kabupaten* Muara Enim required an initial investment of USD 43.104.942. The details are as follows:

Table 9. CAPEX Structure

Gas Plant Cost (in USD)	
EPC (Engineering, Procurement and Construction)	32,576,923
VAT (10%)	3,257,692
Contingency (2%)	651,538
Total CDOC	36,486,154
Insurance cost (0.3%)	97,731
Land cost	4,400,001
Development cost (1.5%)	488,654
Administration cost	1,210,001
Total CDFM	6,196,387
Working capital, staffs, and training	422,401
Total construction cost (US$)	**43,104,942**

Meanwhile, for the first year of operation, OPEX of the power plant is worth USD14.195.753. The details are as follows:

Table 10. OPEX Structure

Operating cost	
Cost of Gas	13,325,000
G&A	122,280
O&M fixed	135,129
O&M variable	28,504
Labor	213,780
Property tax	222,328
Insurance	122,280
Contingency	26,451
Total	14,195,753

Assuming the price of natural gas is used as a flue in the first year of operation is USD 6.5 per MMBTU.

3.3.3. Depreciation Method

The power plant estimated to have economic value 25 years. Follows to Government Regulation No. 52 Year 2011, published December 22, for the tax reduction facilites then the project could depreciated using straight line or double declining method by 10 years of economic life.

3.3.4. Electric *Tariff*

Electric tariff will be calculated after the CAPEX and OPEX known, the costs of data described in the previous subchapter, the electric tariff is calculated as follows

Table 11. Electric Tariff

Electricity tariff	
Component A	0.0393
Component B	0.0055
Component C	0.0446
Component D	0.0012
Electricity tariff	**0.0906**

So the price of electricity generated by the power plant to the *Kabupaten* Muara Enim PT.PLN is worth USD 0.0960 per KWh.

3.3.5. Financial Feasibility of PLTG

The results of the feasibility study of power plant at *Kabupaten* Muara Enim is:

Table 12. Financial Feasibility of PLTG

IRR	13.12%
NPV (USD)	15,175,775
PBP	6.25 years
PI	1.23
ROI	14.58%
ROE	17.76%

From these results it can be seen from the project's NPV is positive, which indicates the project is eligible to run, in addition to the IRR, PBP, PI, ROI, and ROE supports running power plant construction project in the *Kabupaten* Muara Enim this.

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